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SPECIFICATION FOR RATIONALIZED STEELS FOR THE AUTOMOBILE AND ANCILLARY INDUSTRY

PART 24 MECHANICAL AND PHYSICAL PROPERTIES OF 35Ni5Cr2 GRADE STEEL

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Indian Standard

SPECIFICATION FOR RATIONALIZED STEELS FOR THE AUTOMOBILE AND ANCILLARY INDUSTRY

PART 24 MECHANICAL AND PHYSICAL PROPERTIES OF 35Ni5Cr2 GRADE STEEL

0. FOREWORD

0.1 This Indian Standard (Part 24) was adopted by the Bureau of Indian Standards on 25 September 1987, after the draft finalized by the Co-ordinating Committee on Materials for Automobiles had been approved by the Structural and Metals Division Council.

0.2 Part 1 of this standard was published in 1979 which covers the chemical composition of 33 rationalized steels. The mechanical properties, hardenability and isothermal transformation characteristics of these 33 rationalized steels are being covered in different parts of this standard (Parts 2 to 34). The data concerning these properties given in this standard is only for guidance and information purposes.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard (Part 24) covers the chemical composition, mechanical properties, hardenability and isothermal transformation characteristics of 35Ni5Cr2 (35Ni1Cr60) grade of steel for use by automobile and ancillary industry.

1.2 This is an alloy steel, intended to be used in the hardened and tempered condition.

*Rules for rounding off numerical values (*revised*).

2. CHEMICAL COMPOSITION

2.1 The chemical composition of this grade of steel shall be as given below:

Constituents, Percent

C	Si	Mn	Ni	Cr	S	P
0·30-0·40	0·10-0·35	0·60-0·90	1·00-1·50	0·45-0·75	0·035*Max*	0·035*Max*

3. HARDNESS

3.1 The maximum hardness for this grade of steel delivered in the annealed condition when determined in accordance with IS : 1500-1983* shall be 217 HB.

4. MECHANICAL PROPERTIES

4.1 The mechanical properties of this grade of steel in the hardened and tempered condition when determined in accordance with IS : 1598-1977† and IS : 1608-1972‡ shall be as given in Table 1.

TABLE 1 MECHANICAL PROPERTIES IN THE HARDENED AND TEMPERED CONDITION

LIMITING RULING SECTION	TENSILE STRENGTH	YIELD STRESS	ELONGATION G.L., $5{\cdot}65\sqrt{S_0}$, *Min* PERCENT	IZOD IMPACT *Min*	BRINELL HARDNESS HB
(1)	(2)	(3)	(4)	(5)	(6)
mm	MPa	MPa		Joules	
150	690-840	490	14	55	201-248
100	790-940	550	12	50	229-277
63	890-1 040	650	10	50	255-311

5. HOT WORKING AND HEAT TREATMENT TEMPERATURES

5.1 The recommended hot working and heat treatment temperatures shall be as given below:

Hot working temperature	1 200°C *Max*
Annealing temperature	820-850°C
Process annealing temperature	630-670°C
Hardening temperature	820-850°C
Tempering temperature	600°C

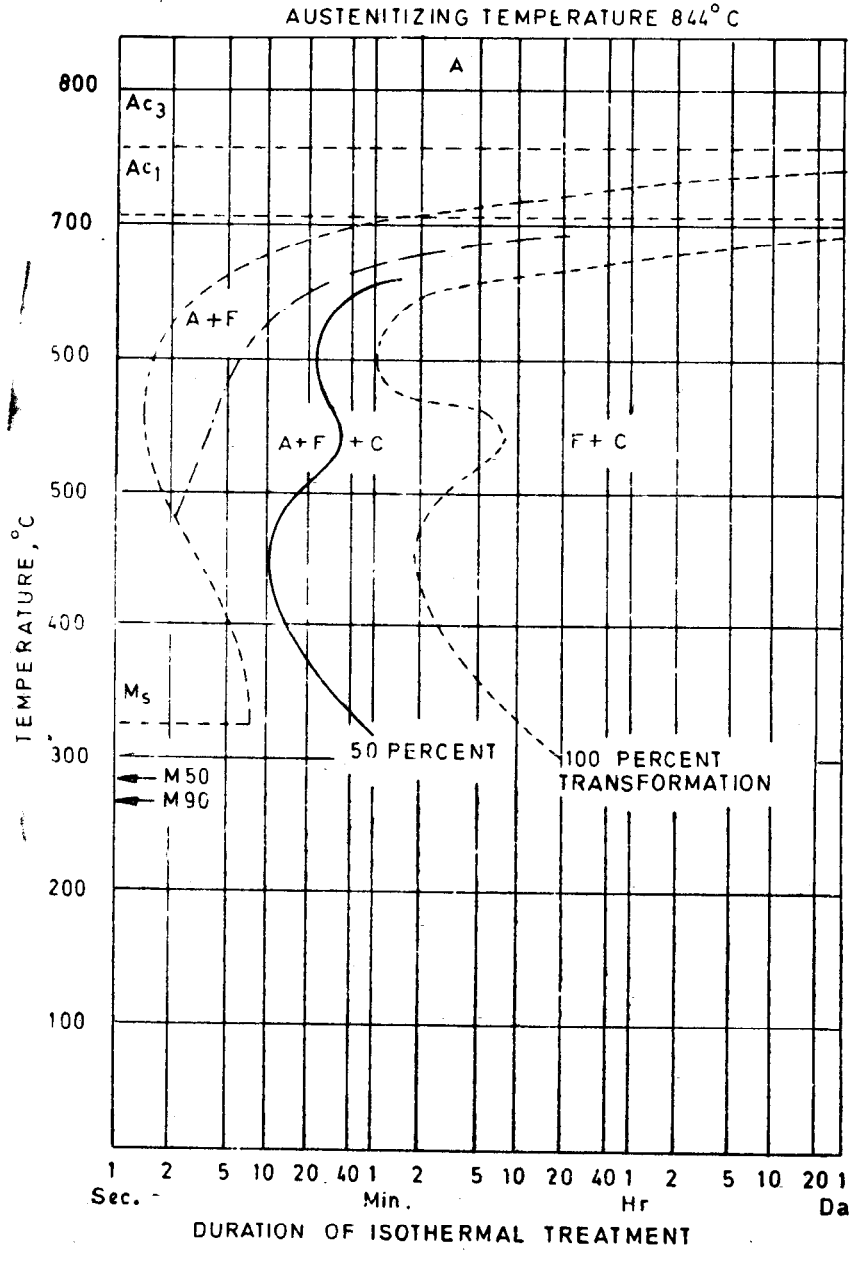
*Method for Brinell hardness test for metallic materials (*second revision*).

†Method for Izod impact test of metals (*first revision*).

‡Method for tensile testing of steel products (*first revision*).

6. TRANSFORMATION CHARACTERISTICS

6.1 The isothermal transformation and continuous cooling diagram for this grade of steel are given in Fig. 1.



Chemical Composition

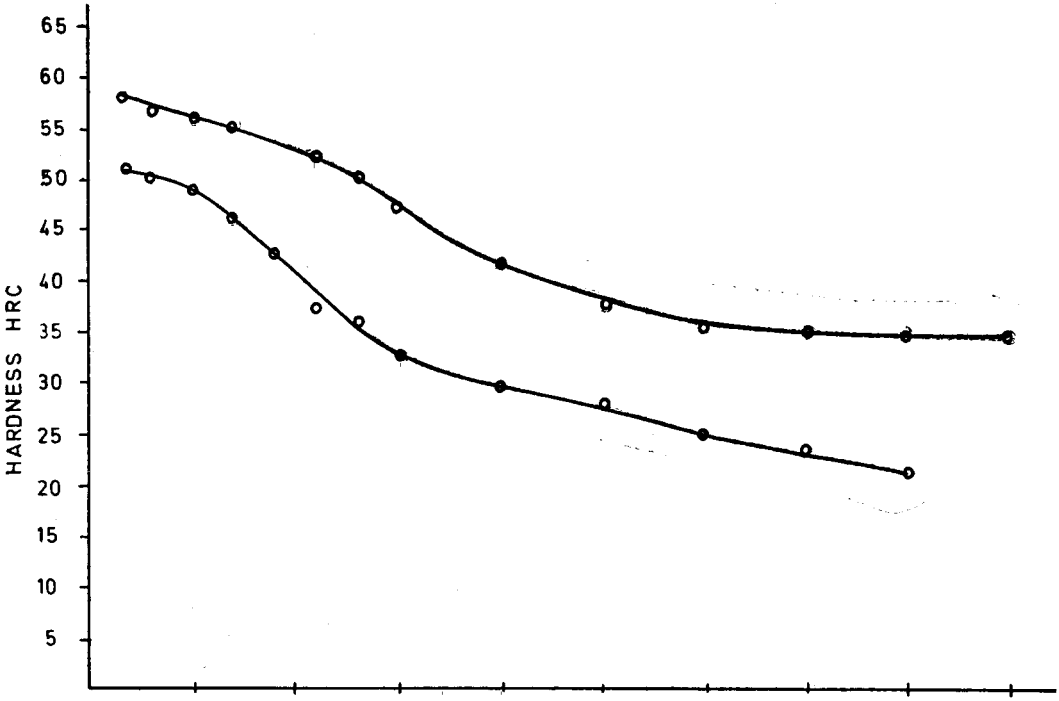
C	Mn	Ni	Cr
0·38	0·72	1·32	0·49

Grain Size 7-8

FIG. 1 ISOTHERMAL TRANSFORMATION DIAGRAM OF 35Ni5Cr2 GRADE STEEL

7. HARDENABILITY

7.1 The end quench hardenability curve is given in Fig. 2.

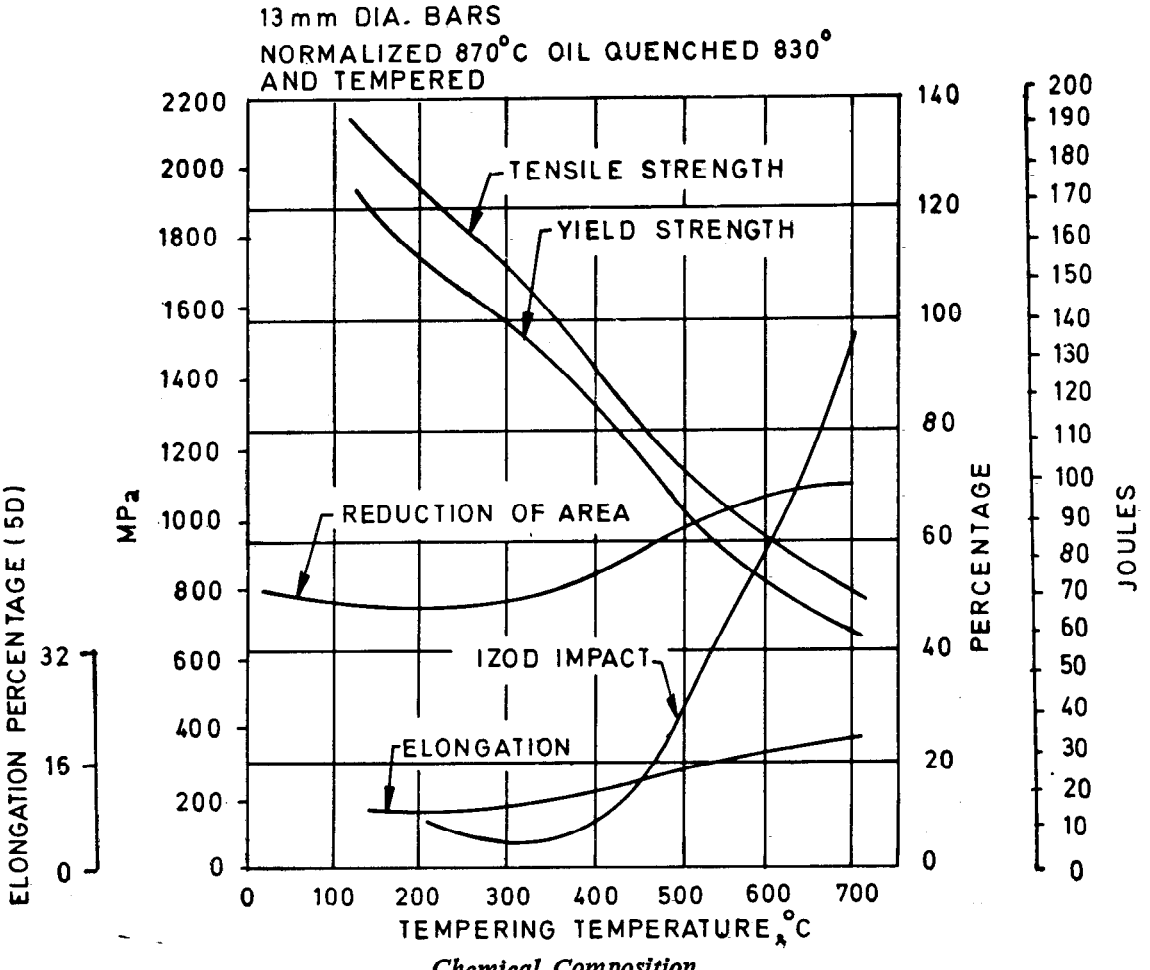


DISTANCE	1	2	3	4	5	6	7	8	9	10	15	20	25	30	35	40	45	50
HRC, *Max*	58	58	57	56·5	56	55·5	55	54	53	51	47	41	37	35	34	34	35	33
HRC, *Min*	51	51	50	49·5	49	47	46	44	42	40	32	29	27	24	22	20	—	—

FIG. 2 END QUENCH HARDENABILITY TEST DATA OF 35Ni5Cr2 GRADE STEEL

8. EFFECT OF TEMPERING ON MECHANICAL PROPERTIES

8.1 The curves for effect of temperature on the mechanical properties of the steel are given in Fig. 3.



Chemical Composition

C	Si	Mn	S	P	Ni	Cr
0·35	0·13	0·65	0·032	0·035	1·27	0·35

As Quenched Grain Size 7

FIG. 3 CURVES SHOWING THE EFFECT OF TEMPERING TEMPERATURE ON MECHANICAL PROPERTIES OF 35Ni5Cr2 GRADE STEEL

9. EFFECT OF SECTION SIZE ON MECHANICAL PROPERTIES

9.1 The curves for the effect of section size on mechanical properties are given in Fig. 4.

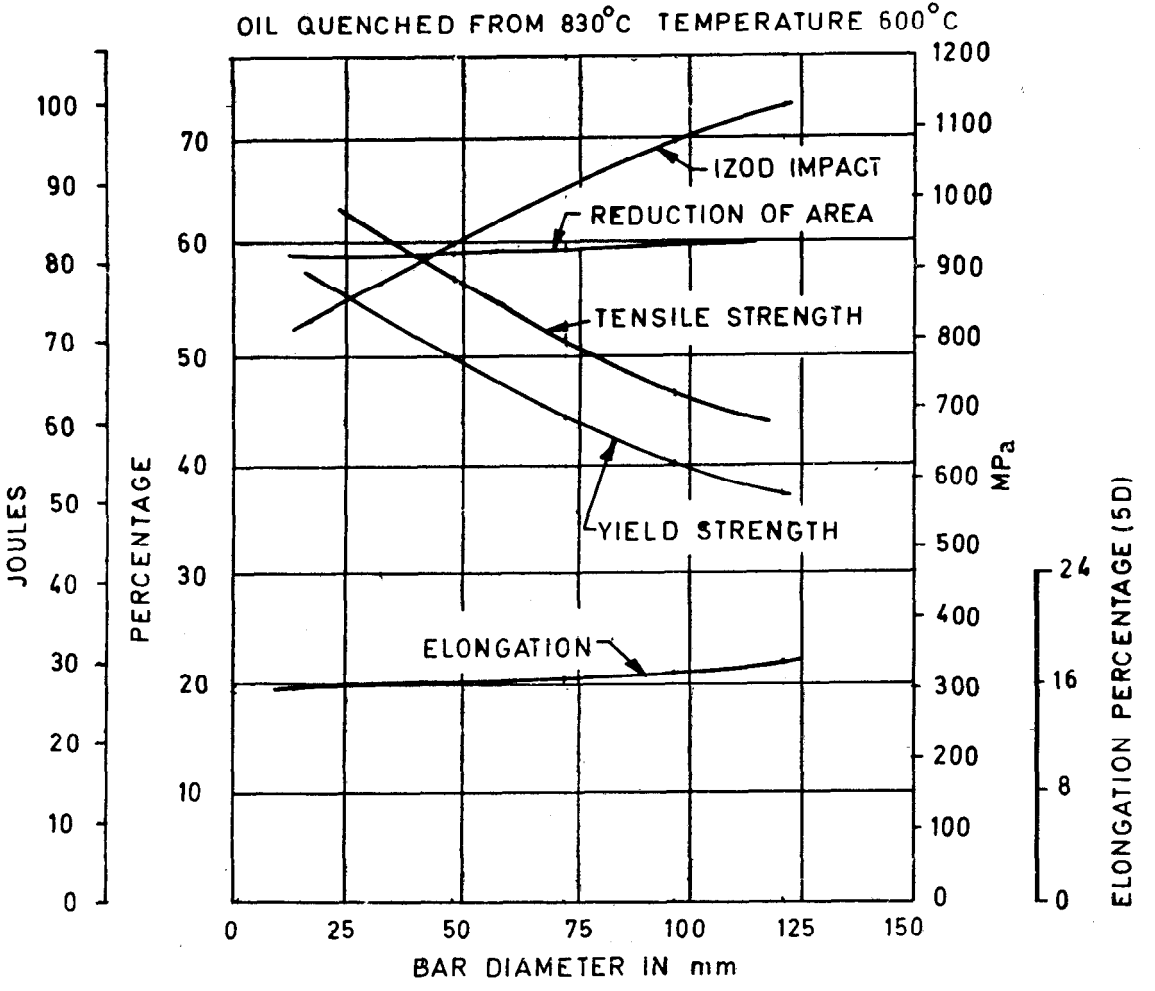


FIG. 4 CURVES SHOWING THE EFFECT OF SECTION SIZE ON MECHANICAL PROPERTIES OF 35Ni5Cr2 GRADE STEEL

(*Continued from page* 2)

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg,m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s(s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2